

REMARKS

Status of the Claims

Claims 1-30 and 32-54 are currently pending in the present application. Claims 1, 7, 14, 23, 32, 33, 39, and 46 are amended. Claims 51-54 are canceled. Claims 55-57 are added. Reconsideration of claims 1-30 and 32-50 is respectfully requested, along with examination of claims 55-57.

Amendments to the Claims

Claims 1, 7, 23, 32, and 39 are amended to recite a pulse width modulated signal in which “the pulse width modulated signal comprises pulses whose widths are based on the FSK signal.” Support for these amendments is found throughout the present application, e.g., see paragraph [0076] of the published version of the present application (U.S. Patent Application Publication No.: US 2002/0150156 A1). Claims 14 and 33 are amended to include the recitations from former claims 52, and 54, respectively. Claim 46 is also similarly amended to include recitations related to converting a frequency shift keying (FSK) signal to a pulse width modulated (PWM) signal. Accordingly, these amendments do not add new matter. Applicant reserves the right to prosecute any of the previous forms of claims 1, 7, 14, 23, 32, 33, 39, and 46 in any related continuing application.

Nonobviousness

In this response, Applicant amends the independent claims 1, 7, 14, 23, 32, 33, 39, and 46. It should be noted, however, that Applicant maintains that the former forms of claims 1, 7, 14, 23, 32, 33, 39, and 46 are patentable over the cited art. In particular, U.S. Patent No. 6,295,271 B1 to Feldman et al. (herein “Feldman”) and U.S. Patent No. 6,823,028 B1 to Phanse (herein “Phanse”) cannot be used to render the former claims obvious because, inter alia, they do not refer to a process control system; and the use of a transformer in Phanse is purely for performing leveling between a transceiver and a local area network (herein “LAN”) – there is absolutely no mention of use of a transformer for transferring data across an isolation barrier. Nonetheless, Applicant amends the claims solely for the purposes of expediting prosecution of

the present application. Indeed, Applicant reserves all rights to prosecute any of the formerly presented claims in a continuing application without prejudice.

A. Claims 1-4, 7-11, 13, 32-36 and 38

Claims 1-4, 7-11, 13, 32-36 and 38 currently stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,295,272 B1 to Feldman et al. (herein “Feldman”) in view of U.S. Patent No. 6,823,028 B1 to Phanse (herein “Phanse”). In light of the amendments to independent claims 1, 7, 32, and 33, along with the remarks herein, these claims are all patentable.

1. Claims 1-4

Amended claim 1 is directed to an input/output circuit of a process control system having a transformer for generating an analog FSK signal across an isolation barrier. The improvement includes having an FSK signal encoded in a PWM signal, in which the PWM signal comprises *pulses whose widths are based on the FSK signal*.

Amended claim 1 is not obvious in light of Feldman and Phanse because neither reference discloses or hints of a PWM signal” in which “the PWM signal compris[es] pulses whose widths are based on the FSK signal.” Phanse is directed to a digital automatic gain control system, and is void of any mention of FSK or PWM signals. Feldman also fails to suggest or hint of the recitations in amended claim 1. In particular, Feldman’s PWM signal does not comprise “pulses whose widths are based on the FSK signal.” Feldman discloses a data system that utilizes a NRZ format to transmit high speed data (see Feldman, col. 5, lines 15-19). Feldman also discloses that the high speed data can be included on a subchannel, in which the subchannel data is different from the NRZ formatted data (see id., col. 4, lines 55-58). It is this subchannel portion that can be FSK formatted (see id., col. 8, lines 12-19). In other words, the widths of the subcarrier channel, which hold the data of the subcarrier channel, are completely independent, and thus not based on, of the NRZ signal data (see also Feldman, FIGS. 4 and 5). Feldman simply lacks any teaching or suggestion of the recitations of amended claim 1.

For at least all these reasons, amended claim 1 is not obvious over any combination of Feldman and Phanse. Claims 2-4 each depend from claim 1. Accordingly, each of the claims is patentable for at least the same reasons that claim 1 is patentable. Claims 3 and 4 are also not obvious because neither Feldman nor Phanse apply their systems to “a workstation, field

controller, field device, smart field device, or other device for process control.” The Office Action continues to suggest that such devices are taught by Feldman. But as stated in Applicant’s previous response, the reference to Feldman, column 1, lines 30-32, only refers to entire computer systems and control data management devices, not to the specific devices recited in claims 3 and 4. Without any refutation of Applicant’s position, Applicant continues to maintain these independent reasons for the patentability of claims 3 and 4.

2. *Claims 7-11 and 13*

Amended claim 7 is drawn to isolation logic for use in transferring information over a transformer between control devices. The logic includes a modulator that generates a PWM signal between a first and a second control device. The PWM signal comprises pulses whose widths are based on the FSK signal. The claim is patentable over Feldman and Phanse for at least the same reasons that claim 1 is patentable (e.g., the cited art does not teach that the PWM signal comprises pulses whose widths are based on the FSK signal). Claims 8-11 and 13 depend from amended claim 7, and are also not obvious for at least the same reasons. Claim 11 is also not obvious for the reasons that claim 3 is not obvious, i.e., none of Feldman or Phanse teach the recited devices, as previously presented by the Applicant. Also, claim 13 is not obvious since none of the cited art teaches or suggests galvanic isolation as recited in the claim, as previously presented in Applicant’s last response.

3. *Claim 32*

Amended independent claim 32 is directed to a method of operating a process control system having a transformer that transfers an analog FSK signal across an isolation barrier, wherein the FSK signal is encoded in a PWM signal to be transferred by the transformer. The PWM signal comprises pulses whose widths are based on the FSK signal. As such, the claim is not obvious in light of the combination of Feldman and Phanse for substantially the same reasons that claim 1 is not obvious.

4. *Claims 33-36 and 38*

Amended claim 33 is directed to a method of transferring an analog FSK signal over a transformer between control devices. The steps of the method include generating a PWM signal by *converting* a FSK signal to be transferred, and applying the PWM signal to the transformer. As noted in the instant application, the method of claim 33 can help address communication

between a field device and the remainder of a control system in which the field device is electrically isolated (see paragraph [0010] of the published application). When utilizing a transformer to transfer signals over an isolation barrier, the bandwidth limitations of the transformer can be an issue (see *id.*, paragraph [0012]). By converting FSK signals to PWM form before transfer over a transformer, smaller, less costly and less power-hungry transformers can be used than those needed to transfer FSK signal directly (see *id.*, paragraph [0060]). Accordingly, the present application not only suggests the invention of claim 33, but provides motivation for practicing the claim.

Claim 33 includes the recitations of former claim 54. Accordingly, we address the obviousness rejection of claim 54 in light of Feldman, Phase, and U.S. Patent No. 4,899,158 to Saeki et al. (herein “Saeki”) here.

a. Cited Art Fails to Teach all the Elements of the Independent Claim

The cited combination does not teach all the recitations of amended claim 33. None of the cited art teaches or suggests “an FSK signal converted to a PWM signal before being transferred by the transformer.” Neither Feldman nor Phanse provide any teaching, suggestion, or hint of *converting* an FSK signal to a PWM signal, and applying the PWM signal to a transformer. Though Feldman discusses *combining* a high speed data signal with a subchannel signal, the reference *does not discuss converting* a FSK signal to a PWM signal. As stated in Feldman, the “combined signal has *both amplitude variations* caused by the addition of the subchannel carrier *and also has pulse width modulation* caused by perturbation of the zero crossing times of the leading and trailing edges of the high speed data transitions” (see Feldman, column 12, lines 11-15, emphasis added). That is, the high speed data is not based on the FSK subchannel signal. Accordingly, Feldman does not disclose converting of a FSK signal to a PWM signal. Phanse is void of any mention of FSK or PWM signals.

Though the Office Actions states that Saeki provides this teaching, the reference lacks any mention or suggestion of such a recitation. Referring to Saeki, FIG. 1; and column 3, lines 1-10, Saeki discloses a signal T from control circuit 12 that is inputted into a FSK modulator 15 to produce a FSK signal, which can be AM modulated and sent to an antenna for transmission. In other words, Saeki discloses a modulator that *converts a PWM signal to a FSK signal*, which can be subsequently transmitted. This is the *opposite* of the recitation of claim 33, which recites

“converting the FSK signal to a PWM signal.” Accordingly, Saeki does not provide the teachings missing from Feldman and Phanse to render claim 33 obvious.

b. Saeki Teaches Away from the Invention of the Independent Claim

Furthermore, Saeki’s teaching points away from the invention of claim 33. While claim 33 is directed to a method that includes converting a FSK signal to a PWM signal, which is transmitted by a transformer, Saeki actually converts a PWM signal to a FSK signal, which is transmitted by an antenna. In other words, Saeki urges transmitting a signal in FSK form as opposed to PWM form, though a control circuit may originally produce a PWM signal. Thus, in light of the teachings of Saeki, a person of ordinary skill in the art would not look to transmitting a PWM signal, but rather some type of FSK signal – in contradistinction to the invention of claim 33.

c. No Motivation to Combine the Cited Art to Teach Claim 33

Finally, there is no motivation to combine the teachings of Feldman, Phanse, and Saeki to render claim 33 obvious, assuming *arguendo* that the cited combination taught the recitations of the amended claim. Feldman is directed to a subchannel-modulation scheme for carrying subchannel data superimposed on a NRZ format gigabit data stream. Phanse is directed to an automatic gain control system for use in a transceiver that can operate in a high frequency Ethernet LAN. Saeki discloses a moving object discriminating system that transmits data between a non-contacting responder and interrogator by using an oscillator to provide a fixed frequency non-modulated carrier signal. Accordingly, these three references are directed to such different applications that one of ordinary skill in the art would not combine their teachings.

Though the Office Action suggests that one would combine Saeki with Feldman to increase data rate transfer, there is absolutely no hint or suggestion to use Saeki’s AM technique with a transformer to send a PWM signal which is a converted FSK signal. Furthermore, the combination of Saeki and Feldman would render Feldman’s subchannel carrier inoperable. While Feldman is directed for use with high speed data networks that move large amounts of data (1 GB+), Saeki is directed to a completely different type of communication mechanism, i.e., non-contacting signaling through antenna that are driven by some oscillator. Accordingly, the components of the systems are specifically tailored to different functions. The use of an oscillator as described in Saeki would ruin the subchannel carrier of Feldman since the oscillator

would essentially wipe out the subchannel. Thus, combining Feldman and Saeki would render the teachings of Feldman inoperable.

For at least all these reasons, amended claim 33 is not obvious over any combination of Feldman, Phanse, and Saeki.

Claims 34, 35, 36, and 38, depending from claim 33, are accordingly not obvious for at least the same reasons that claim 33 is not obvious. In addition, claims 34 and 35 are not obvious for the same reasons that claim 2 is not obvious, claim 36 is not obvious for the same reason that claim 3 is not obvious, and claim 38 is not obvious for the same reason that claim 13 is not obvious.

Accordingly, claims 1-4, 7-11, 13, 32-36 and 38 are all patentable over the cited art.

B. Claims 5, 6, 14-20, 22, 23-29, 31, 39-43, 45-48 and 50-54

Claims 5, 6, 14-20, 22, 23-29, 31, 39-43, 45-48 and 50-54 are currently rejected under 35 U.S.C. 103(a) as being unpatentable over Feldman in view of Phanse and in further view of Saeki. The claims, however, are not obvious because the cited art, in any combination, does not teach, suggest or motivate the claimed invention.

1. Claims 5 and 6

Claims 5 and 6, each dependent from claim 1, are not obvious in light of Feldman and Phanse for at least the same reasons for that claim 1 is not obvious, e.g., none of the references teaches, suggests, or motivates generating an analog FSK signal encoded in a PWM signal that is transferred over an isolation barrier with a transformer, with the PWM signal comprising pulses having widths based on the FSK signal.

2. Claims 14-20 and 22

Amended claim 14 is directed to an input/output module for use in industrial, manufacturing, service, environmental or process control to transfer information over an isolation barrier between control devices. The module comprises transformer logic that inductively transfers a PWM signal being a converted analog FSK signal across the isolation barrier from a first control device to a second. The transformer logic also inductively transfers an AM signal across the isolation barrier, the AM signal encoding another analog FSK signal to

be transferred from the second control device to the first. As discussed above with respect to claim 33, the combination of Feldman, Phanse, and Saeki does not suggest or motivate one to utilize transformer logic that inductively transfers a PWM signal, being a converted analog FSK signal, across an isolation barrier from a first control device to a second device. Nor does the combination suggest coupling such logic with further logic that transfers an AM signal from the second device to the first that encodes another FSK signal. Accordingly, claim 14 is not obvious.

Since claims 15-20 and 22 all depend from claim 14, the claims are also not obvious for at least the same reasons. The Office Action repeats an earlier argument that claim 17 is obvious since Applicant has not disclosed an advantage of not transferring a FSK signal. In Applicant's previous response, Applicant pointed to paragraphs [0067] and [0068] of the published application, with reference to FIG. 3, describing that the first modulator can generate a signal with fixed duty cycle to produce a carrier wave on the field side to be modulated and sent back to the control side. Thus, the need for a specialized transmitter can be avoided. As previously stated, there is no teaching, suggestion, or motivation in any of the cited art to practice the subject matter of claim 17. In lieu of any response to this argument, Applicant respectfully requests allowance of claim 17.

With regard to claim 22, Feldman does not teach that the control devices can be any of a workstation, field controller, field device, smart field device, or other device for any of industrial, manufacturing, service, environmental, or process control, as discussed earlier. Indeed, Feldman's high data density systems are only used with large computer systems that require high speed, large throughput and large bandwidth since huge amounts of information are being processed (see Feldman, column 1, lines 20-30).

3. Claims 23-29 and 31

Amended independent claim 23 is directed to a control system that includes a first analog source that generates a first FSK signal to transfer information between a first control device and a second control device, and a first modulator coupled to the first analog source for generating a PWM signal, the PWM signal comprising pulses whose widths are based on the FSK signal. As such, the combination of Feldman and Phanse cannot render claim 23 obvious, independent of the other recitations of the claim, because there is no suggestion or motivation to in the cited art

to arrange the recited elements of claim 23 at least for the reasons discussed earlier with respect to claim 1. Since claims 24-29 all depend from claim 23, they are also not obvious for at least the same reasons that claim 23 is not obvious. As previously stated in Applicant's previous response, claim 31 is canceled, rendering its rejection moot.

4. *Claims 39-43 and 45*

Amended claim 39 is drawn to a method for transferring information over an isolation barrier between first and second control devices. The method includes inductively transferring a PWM signal across the isolation barrier, the PWM signal comprising pulses whose widths are based on a FSK signal. Accordingly, the combination of Feldman, Phanse, and Saeki cannot render claim 39 obvious because there is no suggestion or motivation to in the cited art to practice the recited step of the method, as discussed earlier with respect to claim 1. Claims 40-43 and 45 depend from claim 39, and are also not obvious for at least the same reasons that claim 39 is not obvious.

5. *Claims 46-48 and 50-54*

Amended claim 46 is drawn to a method of operating a control system. The method includes generating a PWM signal by converting a first FSK signal to the PWM signal. Accordingly, the combination of Feldman, Phanse, and Saeki cannot render claim 46 obvious because there is no suggestion or motivation to in the cited art to practice the recited step of the method, as discussed earlier with respect to claim 33. Claims 47, 48, and 50 are also not obvious in light of the cited art for at least the same reasons that claim 46 is not obvious since the claims all depend from claim 46.

As discussed above, claims 51-54 are canceled without prejudice. Their rejection is thus rendered moot.

C. *Claims 12 and 37*

Claims 12 and 37 are currently rejected under 35 U.S.C. 103(a) as being unpatentable over Feldman in view of Phanse and in further view of U.S. Patent No. 6,297,691 B1 to Anderson et al. (herein "Anderson"). The claims, however, are not obvious because the cited art neither suggests nor motivates either claim. Claim 12 is dependent from claim 7. As such,

claim 12 is not obvious in light of Feldman and Phanse at least for the reasons that claim 7 is not obvious. Anderson fails to provide adequate teaching, along with Feldman and Phanse, to practice claim 12. Though Anderson reveals the use of the HART system to transmit FSK signals, such teaching is in the context of a system that modulates and demodulates signals between a coherent and non-coherent signal protocol. Anderson is completely void of any mention, suggestion, or hint of a modulator that generates a PWM signal from a converted FSK signal to be transferred between control devices. As such, the reference fails to provide the suggestion or motivation lacking in Feldman and Harris to practice claim 7. Accordingly, Anderson's teachings still fall short in being able to render dependent claim 12 obvious, despite its mention of the HART system. Claim 37, dependent from claim 33, is also not obvious for at least the same reasons as stated with respect to claim 12.

D. Claims 21, 30, 44, and 49

Claims 21, 30, 44, and 49 are currently rejected under 35 U.S.C. 103(a) as being unpatentable over Feldman in view of Phanse and in further view of Saeki and Anderson. As discussed above, however, none of the cited art provides the suggestion or motivation for practicing any of the corresponding independent claims from which the currently rejected claims depend (i.e., independent claims 14, 23, 39, and 46, respectively). Accordingly, each of claims 21, 30, 44, and 49 are patentable over the cited art.

New Claims

New claims 55-57 each ultimately depend from at least one of independent claims 14, 33, and 46. Accordingly, the claims are patentable for at least the same reasons that the independent claims are patentable. As well, the claims add recitations that have been discussed in the section describing the patentability of claim 1. Accordingly, the claims are additionally patentable for the reasons that claim 1 is patentable. Entry and allowance of the new claims is respectfully requested.


CONCLUSION

In view of the amendments and remarks above, Applicant submits that claims 1-30, 32-50, and 55-57 are in condition for allowance, and allowance thereof is respectfully requested. Applicant encourages the Examiner to telephone the undersigned in the event that such communication might expedite prosecution of this matter.

Applicant hereby petitions for a two (2) month extension of time to and including January 23, 2007 to file a response to the Office Action mailed August 23, 2006. In the event that a further petition for an extension of time is required to be submitted at this time, Applicant hereby petitions under 37 CFR 1.136(a) for an extension of time for as many months as are required to ensure that the above-identified application does not become abandoned. Credit card payment by EFS web includes the amount of \$450.00 to cover the large entity fee set forth in 37 CFR 1.17(a)(1) and 1.16(f), and the Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 141449, under Order No. 102314-145.

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